



CALS TEST NETWORK

CTN Test Report

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Prepared for
CALS Test Network (CTN)
Wright-Patterson AFB OH 45433-5000

COMPUTER ASSISTED DATA ACCEPTANCE PROCEDURES

Quick Short Test Report

February 22, 1991

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FINAL

**Computer Assisted
Data Acceptance Procedures**

**CONTRACT NO. DAAB07-89-D-A047
TASK ASSIGNMENT PLAN NO. 90-006**

Prepared for:

**Department of the Army
PM CALS**

22 February 1991

By:

**ACCURATE
Information Systems, Inc.**

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless designated by other documentation.

FINAL

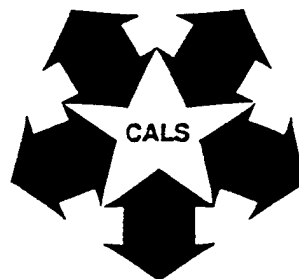
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**Department of the Army
PM CAL S**

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1.0 INTRODUCTION

Data Acceptance (DA) is the means by which a user officially accepts or rejects engineering data purchased from a contractor, based on the quality of the data. Data Acceptance by the military services for the acquisition and logistic support of weapon systems is a high priority within the Department of Defense (DoD). The Computer-aided Acquisition and Logistic Support (CALS) initiative, introduced in 1985, has further emphasized this priority since data must be delivered electronically, in a digital format, to decrease the cost of acquisition and logistic support while maintaining high quality.

Skilled engineering data repository personnel, trained to accept data in a microform format, such as aperture cards, must now transfer their expertise to the acceptance of digital data. Data Acceptance is presently accomplished by viewing images displayed on high resolution image workstations, making this task labor intensive and error prone. The time consuming nature of visual inspection adversely impacts the repository mission of data storage and distribution.

There is a need to automate the acceptance of digital data to improve its productivity. This will reduce the repository staff labor required, thereby reducing the cost of Data Acceptance while maintaining a high quality of data stored in the repository.

It is recommended that pre-acceptance be performed at the contractor site. Pre-acceptance is the application of automated data acceptance to the early detection and correction of data at the source. This will minimize the requirements for extensive Quality Assurance (QA) at the government receiving sites.

2.0 PURPOSE

The purpose of this document is to present a set of proposed Computer Assisted Data Acceptance (CADA) procedures for CALS-compliant engineering data. To meet this objective, the document describes which manual procedures can be automated so they can be implemented within the pre-acceptance function of data acceptance, the data quality issues of pre-acceptance and contract items that are applicable to the acceptance of digital engineering data.

3.0 SCOPE

The scope of this document includes an Introduction section that describes why automation is needed, an Approach section which provides a background of what has been done and how technology can be used to automate the pre-acceptance of engineering data and a section that defines those manual procedures that can be automated by this technology and where they can be implemented. A Pre-acceptance section has been included that describes the data quality issues associated with engineering data as they relate to computer assisted data acceptance at contractor sites and user sites. Contract items are discussed and finally the CADA procedures are presented as functional steps for implementation at the pre-acceptance stage of data acceptance.

The procedures apply to both raster and Initial Graphics Exchange Specification (IGES) engineering data. However raster data is emphasized because it is currently the predominant data delivered and stored in the repositories. The implementation of the CADA procedures, as presented herein, encompasses the pre-acceptance function of data acceptance.

4.0 APPROACH

The CALS Test Network (CTN) initiated a multi-phase effort in which Army Project Manager CALS (PM CALS) is to develop data acceptance procedures for CALS-compliant data. This task was begun by documenting manual procedures for the acceptance of digital data at existing Army and Air Force repository sites. The resulting procedures were reviewed by both the Army and Air Force, and tested at one Army site.

The next step then was to determine if technology exists that can provide the techniques and tools for the implementation of computer assisted data acceptance. Research was conducted and commercially available software packages were tested on a common platform. Using this software, a limited set of engineering drawing files were analyzed to demonstrate that technology necessary to automate the acceptance of digital engineering drawing data does exist.

Concurrent with the field testing, a model of engineering data acceptance was developed. This model, as described in the Army PM CALS report *Model - Engineering Data*, presented an overview of the attributes of the repository's requirements for the acceptance of engineering data, in CALS format, from its generation to its final destination.

After reviewing and testing the manual procedures, and upon development of the engineering model, it became apparent that the requirement for viewing each image on a high resolution image workstation was labor intensive, time consuming and error prone. This led to the proposal of performing data pre-acceptance to reduce the amount of visual inspection.

Pre-acceptance is a function where demonstrated technology can be applied to automate the manual data acceptance process. It can be performed at the contractor site or the government repository.

5.0 AUTOMATION OF MANUAL PROCEDURES

The objective of automation is to achieve a higher level of productivity than would be possible solely by manual handling and visual inspection of data, while maintaining data quality. Manual procedures, shown in Figure 1 and Figure 2, have been analyzed to identify candidates for automation and to determine the feasibility of applying automation and the extent to which it can be applied. Procedures at both contractor and government sites identified in two previous reports have been analyzed. The resulting procedures are depicted in Figure 3 which shows the flow of data from the contractor site to the government site.

5.1 Contractor Site Procedures

Contractor site procedures identified in the Army PM CALS report *Contractor Site Digital Data Acceptance/Quality Assurance Procedures* have been analyzed. These procedures are summarized in Figure 1. Following are the results of the analysis.

1. Contractor Source System Validation and Data Preparation

The government representative reviews evidence to validate that the contractor's source system is capable of producing digital data as specified in the contract and that the contractor has a government approved QA program in place. This is a one-time or infrequent administrative procedure, and is not a candidate for automation.

2. Magnetic Tape Format Validation

The government site validates the format of a sample deliverable of digital data produced by the contractor. This is a one-time or infrequent administrative procedure, and is not a candidate for automation.

3. Creation of Document Identifier Report

The contractor creates a deliverable Document Identifier Report (data list) that has the key identification data of the deliverable data. This procedure is a candidate for automation of both the creation of the Document Identifier Report and the transmittal of the report. The creation of the report is a labor intensive task and is error prone.

Computer Assisted Data Acceptance Procedures

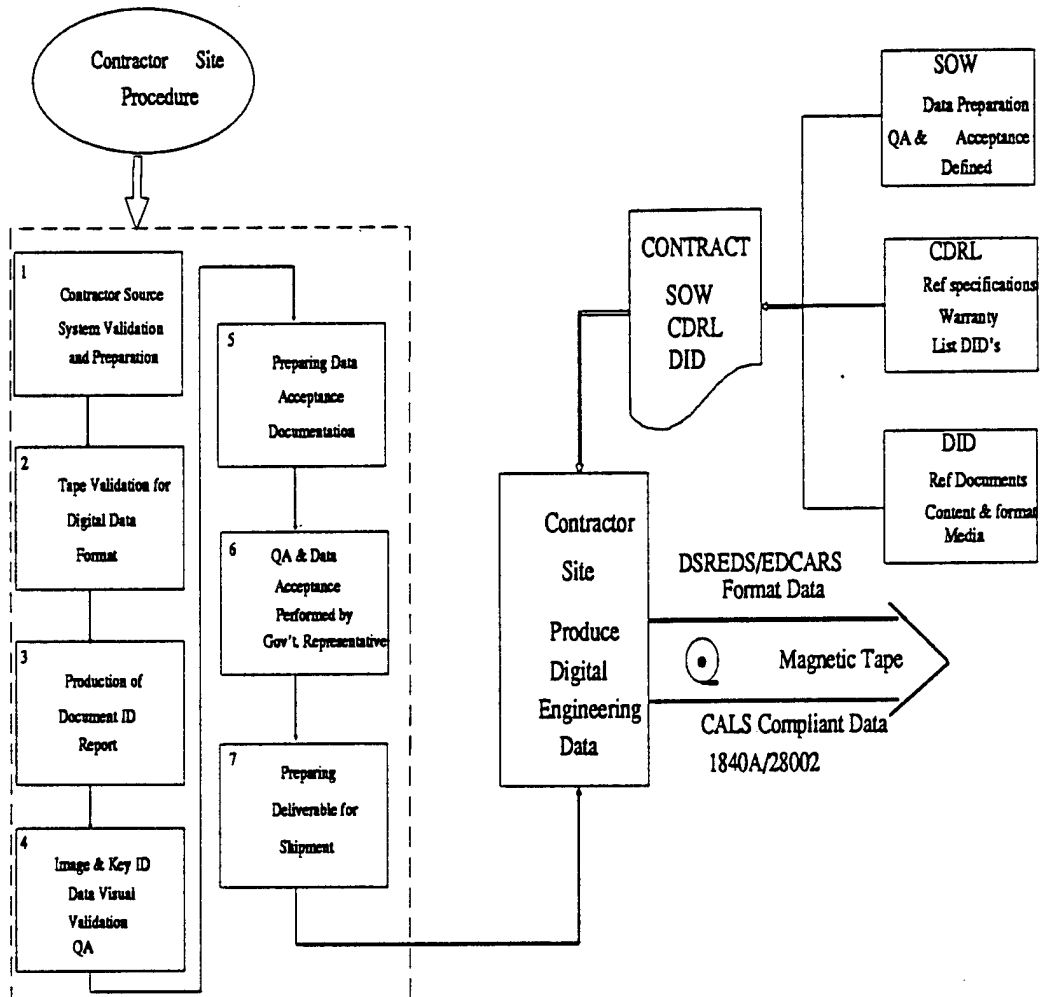


Figure 1 - Contractor Site Manual Procedures

Computer Assisted Data Acceptance Procedures

4. Visual Validation of Image and Key Identification Data

Qualified inspectors view 100% of the digital data images on CRTs to accept or reject the digital data and to update the Document Identifier Report with the results. This procedure is a candidate for the automation of the update of the Document Identifier Report since a manual update of the report is labor intensive and can introduce errors.

5. Preparing Data Acceptance Documents

The government inspector prepares and officially endorses a Data Acceptance Sheet that contains summary information from the Document Identifier Report. This procedure is a candidate for the automation of the creation of the Data Acceptance Sheet since manually creating it is labor intensive and can introduce errors.

6. QA and DA performed by a Government Representative.

Provide pre-acceptance verification at the contractor site. This procedure is a candidate for automation because performing the QA and DA and documenting the results are labor intensive and error prone tasks.

7. Preparing Deliverable for Shipment

The contractor packages the deliverable data as specified in the contract and delivers it to the government site. This is a manual procedure and is not a candidate for automation.

5.2 Government Site Procedures

Government site procedures identified in the Army PM CALS report *DSREDS/-EDCARS Site Digital Data Acceptance/Quality Assurance Procedures* have been analyzed. These procedures are summarized in Figure 2. Following are the results of the analysis.

1. Government Contract Preparation

This procedure defines what should be included in a contract or the supporting documents. Examples are Contract Data Requirement Lists (CDRL), Statements of Work (SOWs), and Data Item Descriptions (DIDs). This is a one-time or infrequent manual and administrative procedure, and is not a candidate for automation.

2. Government Conducts Final Technical Reviews

This procedure describes what technical reviews are performed and who performs them. This is an infrequent administrative procedure and is not a candidate for automation.

3. Physical Acceptance of Magnetic Tape

Physical acceptance of deliverable media is a step that must be performed upon receipt of any physical media (magnetic tape, optical disk, etc.). This is a manual and administrative procedure, and is not a candidate for automation.

4. Conversion of CALS-compliant Data to Native Format.

This conversion must occur if CALS-compliant deliverable data is not compatible with a user system native format. The conversion will require software either on a front-end system, a stand-alone system or on the user system. This is a possible candidate for automation but is primarily a repository function that does not involve Pre-Acceptance of the deliverable data.

Computer Assisted Data Acceptance Procedures

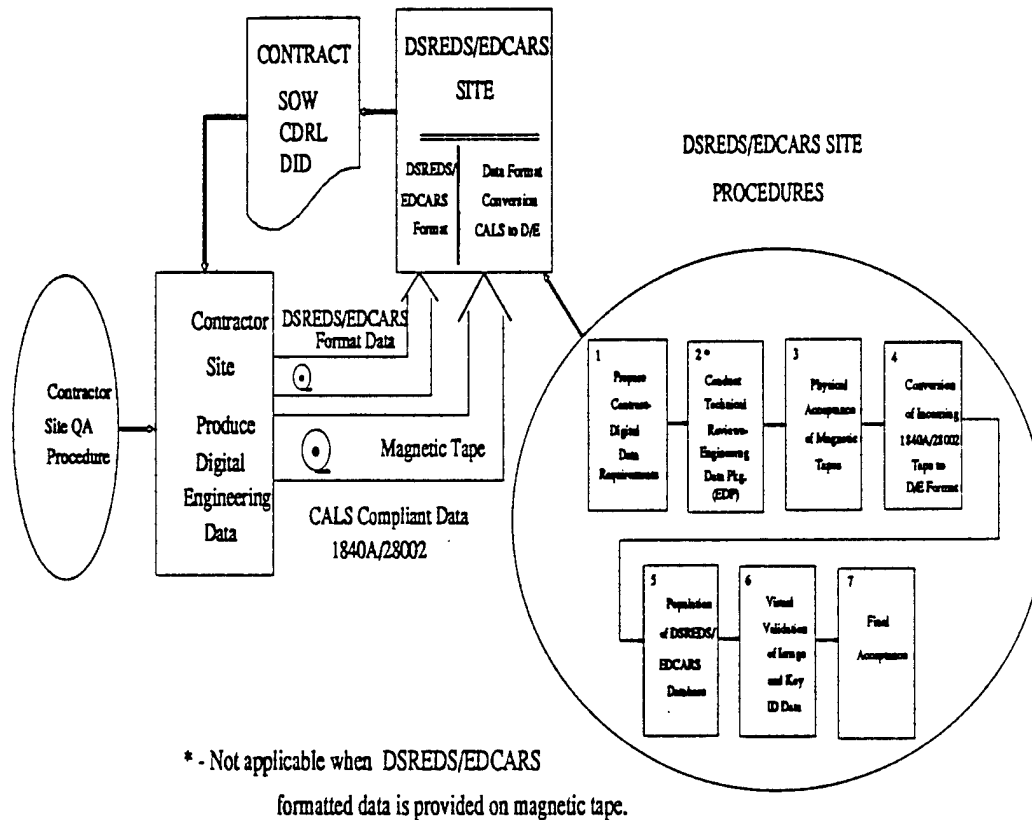


Figure 2 - Government Site Manual Procedures

Computer Assisted Data Acceptance Procedures

5. Population of DSREDS/EDCARDS Databases.

The government site loads the converted data into the user database, produces hardcopy population reports, compares them to the Document Identifier Report, and prepares a Population Acceptance Sheet. This procedure is a candidate for automation of the creation of the Population Acceptance Sheet since manually creating it is labor intensive and can introduce errors. This is a repository function performed on native-format data and has not been addressed as an automated Pre-Acceptance procedure.

6. Visual Validation of Images.

The government site validates the image quality, key identification data, and contract specified requirements for each image as part of the final QA and DA. This is a repository function performed on native-format data and has not been addressed as an automated Pre-Acceptance procedure.

7. Final Acceptance

The government prepares the proper forms for accepting and rejecting the data. This is a manual procedure and is not a candidate for automation.

5.3 Recommendations

It is recommended that automation be applied to several manual procedures at each site. It is also recommended that some procedures be combined to form a Pre-Acceptance procedure which can be performed at either site as shown in Figure 3. Figure 3 shows the flow of engineering data at both the contractors site and at the government site and where the identified candidates for automation can be implemented. It is recommended that Pre-Acceptance be performed at the contractor site. This will allow early detection and correction of data at the source and minimize the requirements for extensive QA at the government receiving sites. Pre-Acceptance can be performed at the government site when the volume is too small to warrant Pre-Acceptance at the contractor site.

Pre-Acceptance at the contractor site performs the functions of manual procedures 3, 4, 5 and 6, as shown in Figure 1, which were identified as candidates for automation. Procedure 6 should be automated initially but will also require interactive participation by the government inspector during the visual statistical inspection of the data accepted by the CADA processing.

Computer Assisted Data Acceptance Procedures

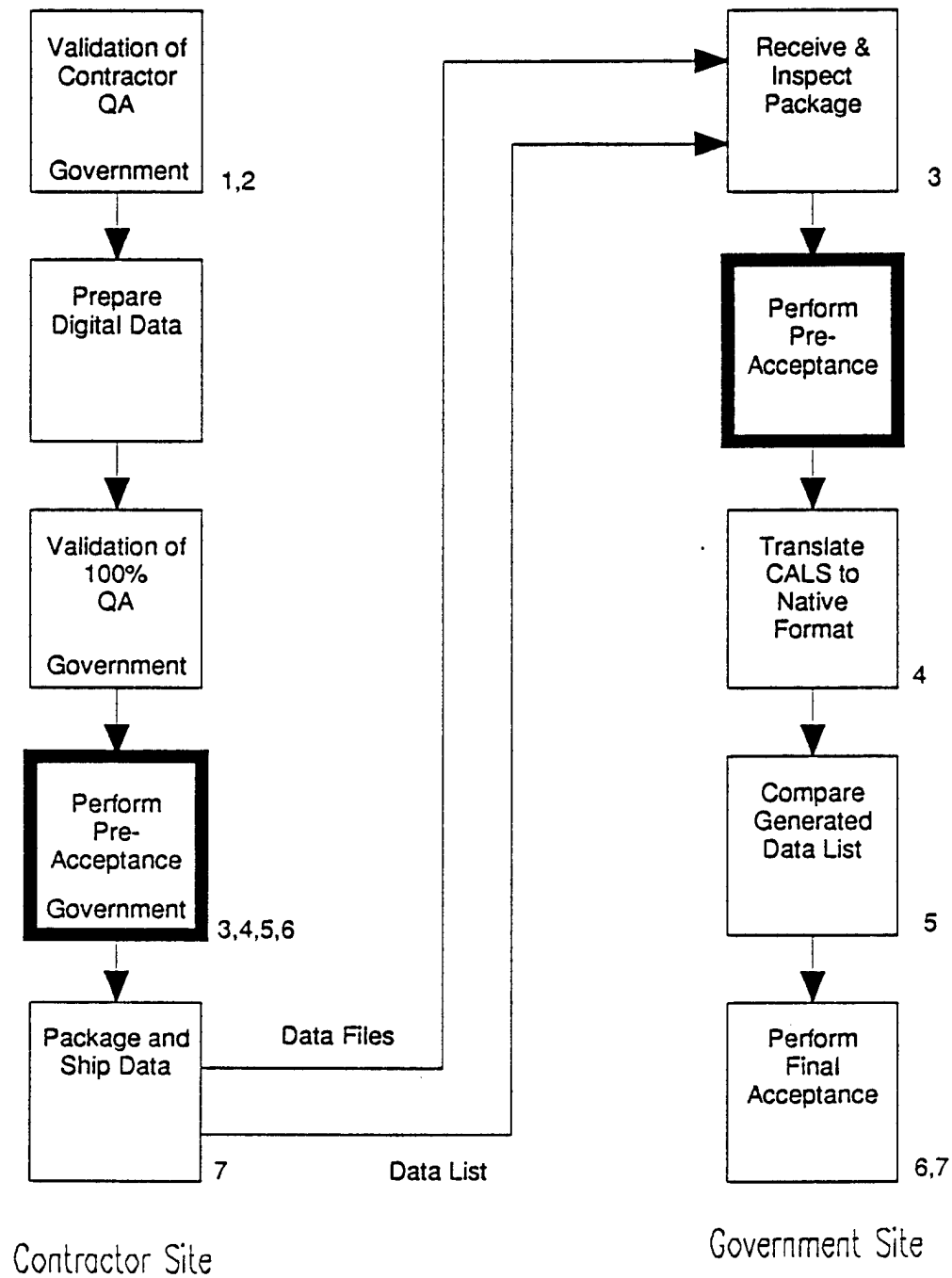


Figure 3 - Data Acceptance Automation

Computer Assisted Data Acceptance Procedures

Figure 3 shows where Pre-Acceptance can be applied at the government site. Manual procedures 4, 5, and 6 are candidates for automation of the converted data.

6.0 DATA PRE-ACCEPTANCE

Data Pre-Acceptance is the application of Data Acceptance to product data at key points in the procurement process prior to the storage of that data in a government repository. Pre-Acceptance of product data helps a government agency to ensure that all product data stored in its repository is of high quality. Computer-assisted techniques can be used to automate Pre-Acceptance to reduce the amount of visual inspection required.

Pre-Acceptance can be performed at a contractor site, a government site, or both sites. The degree of Pre-Acceptance performed at any site depends on circumstances and will be specified by contract. For example, Pre-Acceptance sites may be chosen based on procurement size and complexity: a large procurement contract with a single contractor may specify contractor site Pre-Acceptance only while a small procurement contract may specify user site Pre-Acceptance only.

Data Pre-Acceptance is performed by a government representative who is a qualified inspector of engineering data. The qualification includes training and experience in the use of computer systems and peripheral devices and recent involvement in the acceptance of engineering data in the micrographic format.

6.1 Data Quality

Data quality is measured by three basic criteria: data format, image quality, and image identification data.

6.1.1 Data Format

The format of the deliverable files must comply with MIL-STD-1840A specifications. Briefly, this means that raster files must be stored in Group 4 compressed format and vector files must be stored in IGES format. Files must have specified header records, and deliverables must have specified declaration files.

The degree of compliance depends on the environment in which the files are verified. If the files are verified on a deliverable physical medium, the format of the files and their physical order can be verified. If the files are verified before they are copied on a deliverable medium, only the format of the individual files can be verified.

6.1.2 Image Quality

Image quality is a characteristic of raster images. It is the degree of legibility and reproduceability of the image. Three key image quality criteria are:

Contrast: Image quality is a function of contrast. Poor quality images will appear too light or too dark. Image contrast can vary but it should be consistent for groups of similar images. Poor quality images will appear significantly darker or lighter than the acceptable range for their type.

Noise: Image noise appears as black and white orphan pixels superimposed on a raster image. An orphan is a pixel or a small group of pixels that is completely surrounded by the contrasting color. A black orphan is a dark orphan surrounded by white space. A white orphan is a white speckle in a filled-in image area (e.g., a line, a character, etc.). An orphan pixel is likely to represent noise instead of image data. An excess of orphan pixels is likely to be noise introduced by the image generation process.

Verticality: Verticality is the angle of orientation of the image with respect to the viewer's reference frame. An excessively skewed image is likely to be missing information due to cropping at the corners.

Image quality is an issue primarily when evaluating raster image data that was digitized from hard copy or aperture card source data. The quality of the raster image may be poor because the source image quality was poor or because noise was introduced by the digitizing process. Image quality is not as important an issue when dealing with raster image data files that were generated directly from a CAD system.

6.1.3 Identification Data

Identification data quality depends on an exact match between the identification data from a digitally stored image and the identification data in the deliverable header. Poor identification data quality results when there is a discrepancy between the two.

For raster product data, the identification data can be obtained from the image file by applying character recognition techniques to convert pixel data in the title

block area to ASCII text. For IGES product data, the ASCII text identification data can be read directly from text entities in the data file.

If the identification data cannot be obtained from the data file, this also constitutes poor identification data quality.

6.2 Data Acceptance Functions

Data Acceptance is the evaluation of data against data quality criteria to determine if it should be accepted or rejected. The process flow of Data Acceptance is shown in Figure 4. The following are key functions of data acceptance.

1. Make an objective evaluation of the contents of the data files using data quality criteria.
2. Make a subjective evaluation of the contents of the data files by visually inspecting them.
3. Make an accept/reject decision about each data file.
4. Make an accept/reject decision about the entire deliverable. This is primarily based on the minimum acceptable percentage: the percentage of accepted files with respect to the total number of files.
5. Document the decisions made and the supporting information required to make those decisions. The documentation includes all identifying information necessary to certify or to authenticate the data.

A record of data acceptance information is maintained. This record contains information about the data files including the results of the objective and subjective evaluations and the decisions made.

The criteria used in making the accept/reject decisions depend upon the circumstances of each procurement contract. For example, user sites may weigh quality criteria differently, the minimum acceptable percentage may vary from contract to contract, etc.

Computer Assisted Data Acceptance Procedures

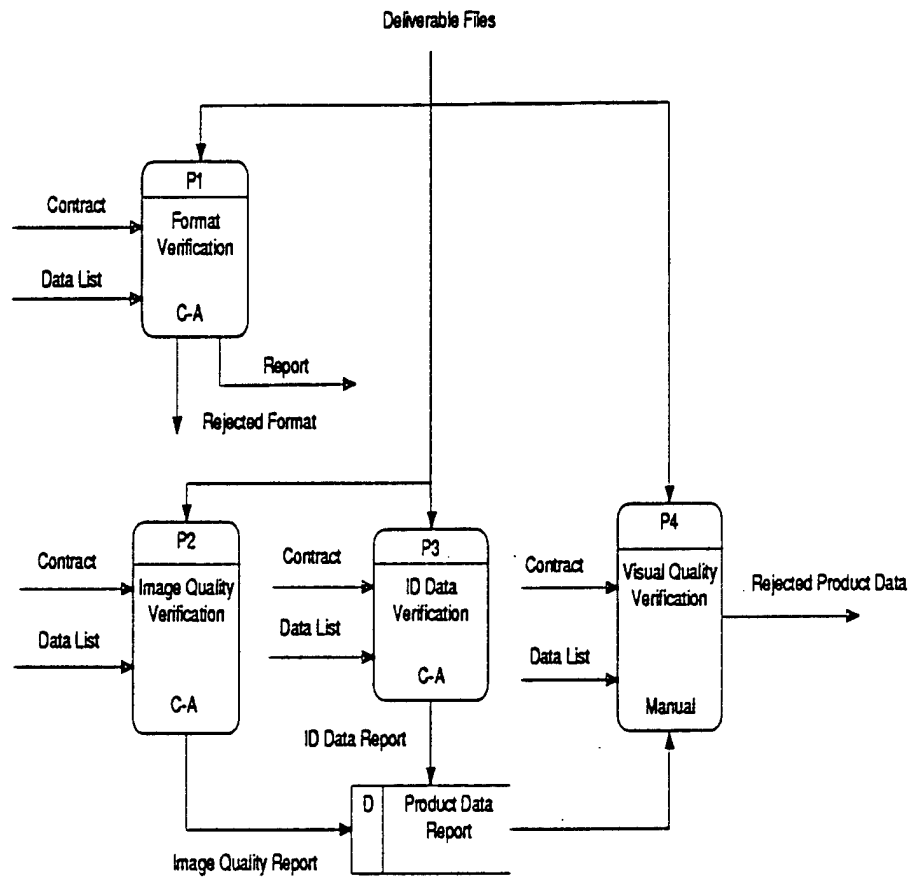


Figure 4 - Data Acceptance

6.3 Contractor Site Pre-Acceptance

At the contractor site, Pre-Acceptance is one component of the Product Data Generation process as shown in Figure 5. A major objective of Pre-Acceptance at the contractor or subcontractor site is to correct problems in product data before it is shipped to the user site. Data Pre-Acceptance may be omitted if the contract specifies it at the user site only.

Data Pre-Acceptance may be performed on the image database system, a front-end to the image database system, or a stand-alone system. A front-end system or a stand-alone system may be either contractor furnished or government furnished.

For erasable physical media, Pre-Acceptance may be performed on the data either on deliverable media or in a Deliverable Files Database. For write-only deliverable media such as optical disk, economic considerations dictate that Pre-Acceptance be performed on data in the Deliverable Files Database. For telecommunications, the only data on which Pre-Acceptance can be performed is in the Deliverable Files Database.

The accept/reject report produced by Pre-Acceptance is used to determine the destination of the deliverable data. Accepted data is delivered to the government site. Rejected data is returned to the contractor for correction.

It is recommended that Pre-acceptance be iterated until there is no rejected data. That is, the contractor will correct any data rejected by Pre-Acceptance. This will ensure that only accepted data will be delivered to the user site.

Computer Assisted Data Acceptance Procedures

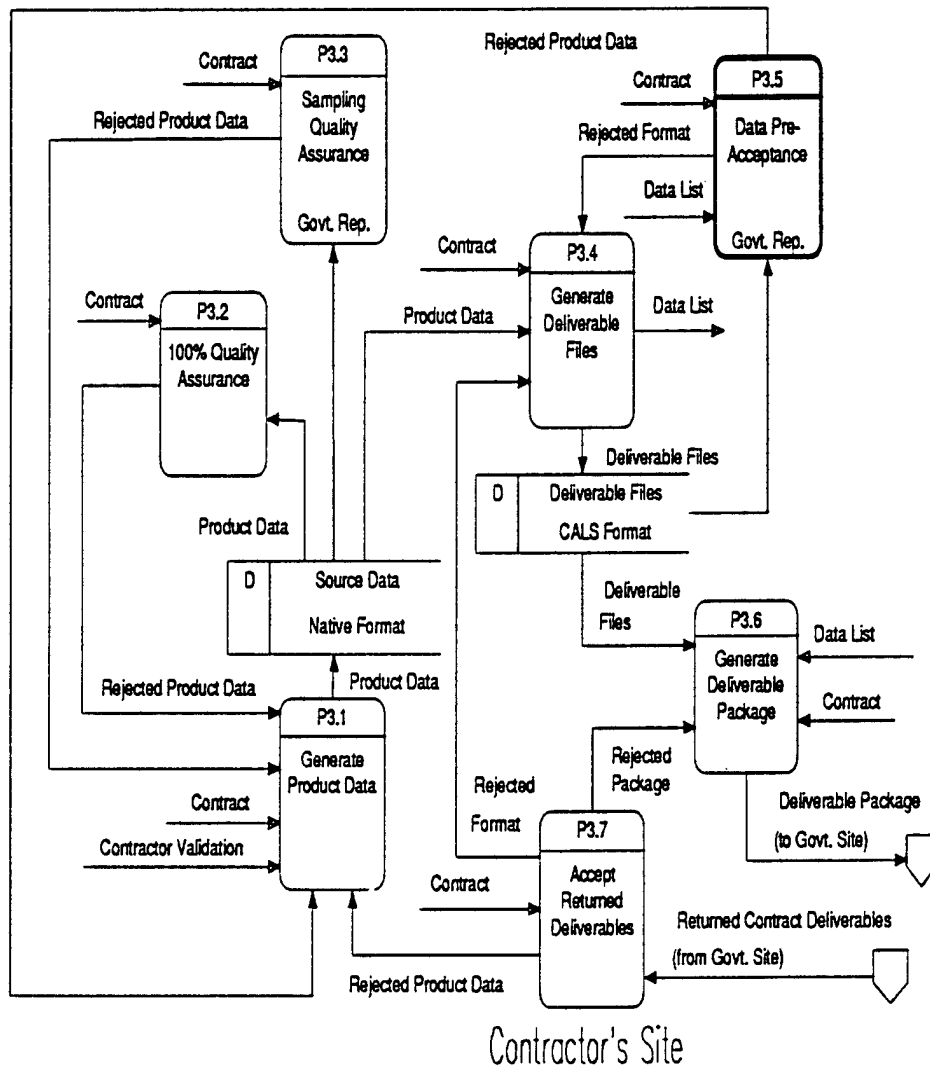


Figure 5 - Product Data Generation

6.4 User Site Pre-Acceptance

At the user site, Pre-Acceptance is one component of the Product Data Acceptance process as shown in Figure 6. A major objective of Pre-Acceptance at the user site is to reduce the impact of Data Acceptance on the user staff. Data Pre-Acceptance may be omitted if the contract specifies it at the contractor site only.

Data Pre-Acceptance may be performed on the repository system, a front-end to the repository system, or a stand-alone system.

The deliverable data may be received by physical media or by telecommunications and stored in a Deliverable Files database. Data Pre-Acceptance is performed on data in this database, i.e., in CALS format before the data is translated to the repository system native format.

If the data cannot be loaded onto the CADA system, it is rejected and returned to the contractor.

The accept/reject report produced by Pre-Acceptance is used to determine the destination of the deliverable data. Accepted data is translated and stored in the repository system. Rejected data is returned to the contractor for correction.

6.5 Automation

Automation can improve productivity in Data Acceptance while maintaining a high level of data quality. Automation can be applied to image evaluation and documentation.

6.5.1 Image Evaluation

Image evaluation by visual inspection to find poor quality images is a labor intensive and error prone task, especially when large numbers of images are involved. Image evaluation can be automated by applying computer assisted techniques to reduce the amount of visual inspection required. This will improve the productivity of visual inspection focusing on fewer images that require human judgement.

Computer Assisted Data Acceptance Procedures

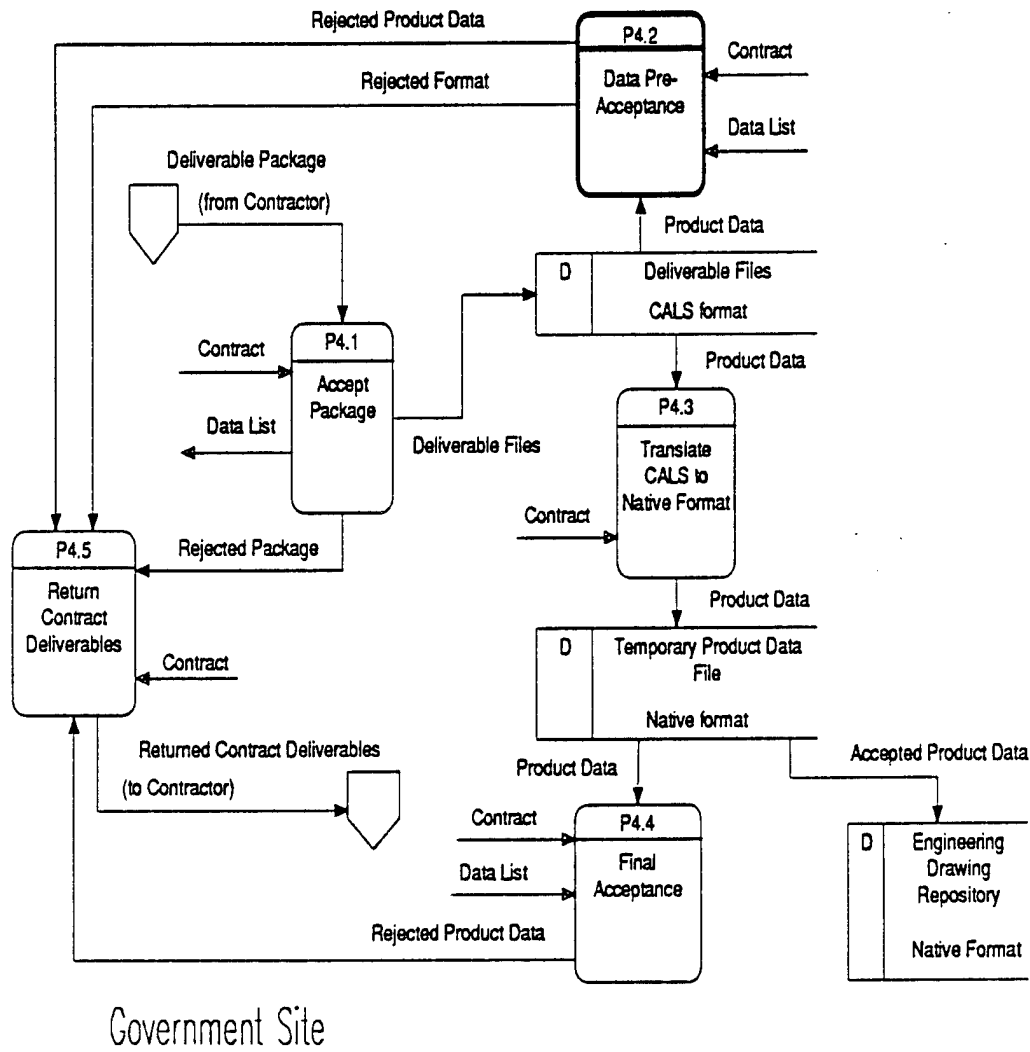


Figure 6 - Product Data Acceptance

An entire image database can be automatically evaluated with no human intervention in finding image quality problems and summarizing them. A sample of images can then be visually inspected to confirm or override the results of the automated evaluation. For example, if there are few rejected images, all rejected images and a statistically determined small sample of accepted images would be visually inspected.

Although the amount of visual inspection can be greatly reduced, the amount necessary will depend on specific circumstances. For example, it can be influenced by user confidence in the image evaluation techniques, user confidence in the contractor performance, local user procedures, the quantity of subcontractor supplied data, etc.

6.5.2 Documentation

The documentation of data acceptance can be automated to maintain information in a database, to update the database automatically as data acceptance progresses, and to eliminate all paper except a final accept/reject report. This report, ready for official endorsement, will document the decisions made and the supporting information required to make those decisions.

6.6 Computer Assisted Data Acceptance System

A CADA system used for Data Acceptance will have the following required basic functions that address the major functions of Data Acceptance.

1. Automatic quality evaluation of all data files.
2. Visual inspection of selected data files.
3. Accept/reject decision about individual files.
4. Accept/reject decision about the entire deliverable.
5. Final accept/reject report.

The CADA system will automatically maintain a database of data acceptance information. The results of the automatic quality evaluation will be recorded electronically as they are determined. Accept/reject decisions will be recorded similarly as they are made.

Computer Assisted Data Acceptance Procedures

The CADA system will store decision criteria as parameters that can be easily modified by a user who can set contract specified values. An example is the minimum acceptable percentage.

CADA functions can be implemented on any type of platform: an image database system (e.g., a government repository system), a front-end to an image database system, or a stand-alone system. The following are basic hardware requirements for a CADA system.

1. Processing speed sufficient to support CPU intensive image processing.
2. RAM capacity sufficient to minimize disk I/O when retrieving/displaying stored images.
3. A video monitor with sufficient area and resolution for image display and user interface.
4. Disk storage capacity sufficient to maintain a database of deliverable data and attributes.
5. Data input device(s) to load deliverable data such as a magnetic tape drive, an optical disk drive, a floppy disk drive, a network interface, or a communications interface.

7.0 CONTRACT CONSIDERATIONS

The contract is the guiding document for the implementation of quality assurance and data acceptance. It determines how, when, where, and by whom quality assurance and data acceptance procedures are implemented. The contract must provide specific guidance for resolving important issues. This section identifies some of these issues and the options available for resolving each.

7.1 Deliverable Data Files

Raster image files of engineering data will be specified in the contract as the deliverable digital data for which these computer assisted data acceptance procedures will be applied. These files will comply with the definitions found in MIL-R-28002, *Requirements for Raster Graphics Representation in Binary Format*. Raster data consists of raster images compressed in CCITT Group IV format.

7.2 Mode of Digital Data Delivery

The contract will specify that the mode of digital data delivery complies with the options identified in MIL-STD-1840A, *Automated Interchange of Technical Information*. Currently, two media forms are acceptable. They are 9-track magnetic tape and optical disk platter. Delivery by telecommunications link may be addressed in a future release of MIL-STD-1840A.

7.3 Computer Assisted Data Acceptance Procedures

The contract will specify that computer assisted data acceptance procedures be applied to the deliverable digital data during the pre-acceptance function of data procurement.

7.4 Location and Schedule of Data Pre-Acceptance

The contract will specify the location and schedule of data pre-acceptance. Pre-acceptance may take place at the contractor site or a government repository. It is recommended that pre-acceptance take place at the contractor's site for major weapons systems; for other smaller procurement contracts, pre-acceptance may be performed at the repository. It is also recommended that data pre-acceptance be scheduled in the period after the deliverable files are in CALS format and before the deliverable files are translated to the format native to its designated engineering drawing repository.

7.5 Data Pre-Acceptance Personnel

The contract will specify who is to perform data pre-acceptance. A memorandum of understanding between the procuring agency, the repository and other concerned agencies will be generated to identify areas of responsibility for each.

7.6 Facility Requirements

The contract will specify what facilities are required to perform data pre-acceptance. This will include, as a minimum: space, utilities, computer hardware and software, peripherals and interfaces. The provider of these facilities will be identified. The contract will state that these facilities will be available to the government inspector during data pre-acceptance.

7.7 Acceptance Criteria

The contract will specify the acceptance criteria that will be used to judge the deliverable data. This will include the definition of acceptable data format, image quality and image identification data; sampling method and minimum acceptable percentage. It is recommended that 100% be the minimum acceptable percentage when data pre-acceptance is performed at the contractor's site.

7.8 Disposition Determination

The contract will specify the action to be taken when the data is rejected or accepted as a result of data pre-acceptance. This will include the destination of the deliverable and the documents that will accompany the deliverable data.

7.9 Data Certification

The contract will state that the contractor will inspect each data file and will produce a document certifying that the inspections have taken place.

7.10 Data Warranties

The contract will specify the terms and conditions of the warranty of deliverable data. This will include duration, notification procedures and return/correction procedures.

7.11 Source System Validation

The contract will specify that the contractor has completed or will complete a validation process to demonstrate the ability to produce engineering data in accordance with MIL-R-28002 for raster or MIL-D-28000 for IGES. The contract will also specify that the contractor has a government sanctioned quality assurance program in place for the production and quality assurance of digital data.

7.12 Transfer Media Format Validation

The contract will specify that the contractor has completed or will complete a validation process to demonstrate the ability to produce engineering data on transfer media in accordance with MIL-STD-1840A.

8.0 DATA PRE-ACCEPTANCE PROCEDURES

Data Pre-Acceptance is accomplished by sequentially performing the procedures in this section. Each procedure is performed by following its steps, which are shown as a checklist with a short explanation of each step. Unless otherwise indicated, the steps should be followed sequentially. Each step should be checked off in the space provided as it is completed.

The procedures are applicable to Pre-Acceptance at a contractor site or a user site. Examples of the application of these procedures are shown in Appendix A on page 42, for a contractor site, and Appendix B on page 49, for a government site.

To be able to perform these procedures, the following prerequisites must be met.

1. All contract considerations, described in section 7 on page 23 must be met.
2. The inspector performing Pre-Acceptance is a government representative who is a qualified inspector of engineering data.
3. A CADA system is available that meets all CADA system functional requirements described in section 6.6 on page 21. All hardware and software have been installed, configured, and tested.
4. The inspector has been trained in the use of the CADA system hardware and software.
5. All manual procedures preceding pre-acceptance have been completed.

The description of the procedures and steps is general since there may be many different implementations of the same CADA system functionality. The procedures deliberately avoid any reference to operational procedures that depend on specific hardware and operating system platforms, commercially available software, user interface standards, means of displaying or printing information, or means of entering information.

8.1 Procedure 1 - Set CADA Parameters

This procedure describes steps used to set CADA system parameters.

The CADA system parameters include site identification, contract identification, and acceptance criteria. The contract identification and acceptance criteria should be obtained directly from the contract.

The parameters are entered into the CADA system on a terminal. Follow data entry procedures for the system being used.

1. Enter Government Agency Name ____

Enter the name of the Government Agency that is the end user of the procured data.

2. Enter Government Agency POC Name ____

Enter the name of the Government Agency's Point-of-Contact (POC).

3. Enter Government Agency POC Telephone ____

Enter the telephone number of the Government Agency's POC.

4. Enter Contractor CAGE ID ____

Enter Contractor's Commercial and Government Entity (CAGE) identification.

5. Enter Contractor Name ____

Enter the name of Contractor organization that is generating the data.

6. Enter Contractor POC Name ____

Enter the name of the Contractor's POC.

Computer Assisted Data Acceptance Procedures

7. Enter Contractor POC Telephone
Enter the telephone number of the Contractor's POC.
8. Enter Inspector Name
Enter the name of the Government Inspector who is performing Pre-Acceptance.
9. Enter Inspector Telephone
Enter the telephone number of the Government Inspector.
10. Enter Data Acceptance Site Name
Enter name of the site at which data acceptance is being performed.
11. Enter Contract Number
Enter the contract number obtained directly from the contract. This will be used by the system to verify that Pre-Acceptance is being performed on the correct deliverable.
12. Enter Number of Deliverable Files
Enter the number of deliverable files obtained from the contractor's documentation. This may be a packing list at the government site or it may be other official documentation produced by the contractor at the contractor's site. This will be used by the system to determine if any data is missing from the deliverable.
13. Enter Minimum Acceptable Percentage
Enter the Minimum Acceptable Percentage. This is the decision criteria used by the system in accepting or rejecting the deliverable. At the government site, this figure is obtained from the contract. At the contractor site, this figure is recommended to be 100%.

14. Enter Data Quality Parameters —

Enter Data Quality Parameters that are decision criteria used by the system in data quality evaluation. The system uses these parameters to determine if individual files are accepted or rejected. These parameters are limits used in the specific data quality evaluation routines. These depend on the system being used and the test it performs on the data.

15. Enter other required parameters —

Enter any other required parameters. These may depend on the system being used or may serve another purpose to be defined in the future. Examples are time/date functions, system security, audit information, etc.

16. Go to Procedure 2 —

The CADA parameters have been set.

8.2 Procedure 2 - Load the Data

This procedure describes the steps used to load deliverable data into the CADA system, verify that it is the correct deliverable data, and verify that it is formatted correctly. The deliverable data may be on physical media or it may be on a Deliverable Files Database. The data is actually loaded only if it is on physical media or if the CADA system is physically separated from the system which has the Deliverable Files Database. If CADA functions are installed on the system that has the Deliverable Files Database, the data is already on the system.

1. Obtain or Identify the Data

If Pre-Acceptance is being performed on physical media, obtain the deliverable data and its associated documentation. If Pre-Acceptance is being performed on a Deliverable Files Database, identify the deliverable data on the system using the contractor's certification documentation. Verify that the deliverable data is that specified by the contract.

At the government site, obtain the data after it has been received in accordance with contract requirements. At the contractor site, if the Pre-Acceptance is being performed on a Deliverable Files Database, obtain certification of the authenticity of the data in the database.

If the data is already on the system in a Deliverable Files Database, go to Step 3.

2. Load the Data

Load the data from a physical medium or copy the data from the system that has the Deliverable Files Database. The data may be copied using physical media, by network connectivity, by telecommunications, etc.

If the data cannot be successfully loaded, it must be rejected because media of incompatibility. Go to Step 7.

3. Verify the deliverable format

The system will verify that the format of the deliverable data files and their headers comply with MIL-STD-1840A. The contents of the files are not necessarily verified at this point. If the data was loaded from a physical medium, the deliverable must have the declaration files and data files in the correct order, the declaration file must have valid records, and data files must have valid header records. If the data was loaded from a Deliverable Files Database, the order of declaration files and data files is not relevant, but the declaration files must have valid records and data files must have valid header records.

If the data does not comply, it must be rejected on the basis of format incompatibility. Go to Step 7.

4. Verify the contract number

The system will read the contract number from the declaration file. It will compare this with the contract number which was entered as a system parameter.

If the contract numbers do not match, the data must be rejected because of improper shipment. Go to Step 7.

5. Verify total number of files

The system will compare the number of deliverable files actually loaded with the number of deliverable files that was entered as a system parameter.

If the number of files do not match, the data must be rejected because of improper shipment. Go to Step 7.

6. Go to Procedure 3

The data has been successfully loaded.

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7. Print the Reject Report —

Print the Reject Report from the system. The system will print a report with all contract information and the specific reasons for rejection.

8. Prepare documentation —

Prepare any additional documentation required by the contract. Sign all applicable documentation.

9. Return the Data —

Return the data and all applicable documentation to the contractor by following procedures in accordance with contract requirements for data rejection procedures. At the government site, follow procedures for packaging and shipping rejected data and all associated documentation to the contractor. At the contractor site, follow procedures for returning physical media or identifying rejected data in a Deliverable Files Database.

When the corrected data is received from the contractor, resume the Pre-Acceptance Procedures. Go to Step 1.

8.3 Procedure 3 - Process the Data

This procedure describes the steps performed to process the data. At this time, the system will perform automatic data quality evaluation on the data files. This will evaluate the data for compliance with data quality criteria described in section 6.1 on page 13

1. Process the data files —

Start the image evaluation processing. The system will perform the automatic data quality evaluation without further intervention.

Depending on the capabilities of the CADA system, the system may do the processing in the foreground or in the background. If the system does the processing in the foreground, the system will be dedicated to this task until it is completed. If the system does the processing in the background, the system can be used for other tasks until this task is completed.

2. Verify that processing is complete —

Verify that the system has completed all processing.

This will depend on the CADA system. If the system did the processing in the foreground, observe the status on the screen. If the system did the processing in the background, follow procedures to determine the status of a background task.

3. Review the status of the deliverable —

When the processing is complete, review the status of the deliverable, observing the number of rejected, marginal, and accepted files, and the status of the deliverable. The status of the deliverable was determined automatically by the system based on the number of individual files accepted. If the number of accepted files meets the minimum acceptable percentage, the system will set the status of the deliverable to 'accepted.' If not, the system will set the status to 'rejected.'

The procedure for reviewing the status of the deliverable will depend on the system being used. It will most likely be displayed

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on a summary screen showing the results of the processing.
Follow the procedures for the system being used.

4. Go to Procedure 4 —

The data has been completely processed.

8.4 Procedure 4 - Analyze the Results

This procedure describes the steps used to analyze the results of processed data. Analyzing the results consists of confirming the reject and accept decisions made by the automatic data quality evaluation. In cases where no decision was made or the data quality is marginal, the inspector must make a decision.

1. Select image quality rejected files for review ____

Select for review any or all files rejected because of poor image quality. If image quality rejected files will not be analyzed, go to Step 3.

2. Review the selected image quality rejected files ____

View the selected image quality rejected files. Override the rejected status to accept any file(s) if necessary based on observed image quality. For each file overridden, enter a comment stating the reason(s) for accepting it.

3. Select identification data rejected files for review ____

Select for review all files rejected because of poor identification data quality. If identification data rejected files will not be analyzed, go to Step 5.

4. Review the selected identification data rejected files ____

View the selected identification data rejected files. Override the rejected status to accept any file(s) if necessary based on observed identification data quality. For each file overridden, enter a comment stating the reason(s) for accepting it.

5. Select marginal files for review ____

Select all marginal files for review. If marginal files will not be analyzed, go to Step 7.

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6. Review the selected marginal files —

View the selected marginal files. Accept or reject each file based on observed data quality. For each file overridden, enter a comment stating the reason(s) for accepting or rejecting it.

7. Select the accepted files for review —

Select a subset of all accepted files for review. It is up to the discretion of the inspector to select a sample for review, based on contract requirements or other circumstances. The system will be able to select files for review by using a statistical sampling technique using criteria that were entered as system parameters. In addition to this, or instead of this, the inspector can select a sample by choosing specific files. If the accepted files will not be analyzed, go to Step 9.

8. Review the selected accepted files —

View the selected accepted files. Override the accepted status to reject any file(s) if necessary based on observed image quality. For each file overridden, enter a comment stating the reason(s) for rejecting it.

9. Review the status of the deliverable —

When the analysis of results is complete, review the status of the deliverable, observing the number of rejected, marginal, and accepted files, and the status of the deliverable. The status of the deliverable was determined automatically by the system based on the number of individual files accepted. If the number of accepted files meets the minimum acceptable percentage, the system will set the status of the deliverable to 'accepted.' If not, the system will set the status to 'rejected.'

The procedure for reviewing the status of the deliverable will depend on the system being used. It will most likely be displayed on a summary screen showing the results of the processing. Follow the procedures for the system being used.

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10. Go to Procedure 5 —

The data has been completely analyzed.

8.5 Procedure 5 - Accept/Reject the Data

This procedure describes the steps used to accept or reject the data officially after it has been evaluated and analyzed.

1. Review the final status _____

Review the final status of the deliverable that was determined automatically by the system. Override the status of the deliverable if necessary based on overall quality of the deliverable. If the status is overridden, enter a comment describing the reason(s) for accepting or rejecting the deliverable.

2. Print the Accept/Reject Report _____

The report will be printed with the actual final status of the deliverable and all documentation necessary to support the decision. If the status of the deliverable is 'accepted,' the system will print an accept report. The accept report will contain information about any rejected files in the accepted deliverable. If the status of the deliverable is 'rejected,' the system will print a reject report.

3. Prepare documentation _____

Prepare any additional documentation required by the contract. Sign all applicable documentation.

If the deliverable was rejected, go to Step 6.

4. Forward the Data _____

Forward the data and all applicable documentation to the next organization in accordance with contract-specified procedures. At the government site, follow procedures for forwarding it to the appropriate repository personnel who will perform final acceptance. At the contractor site, follow procedures for forwarding it to the appropriate contractor personnel for packaging and shipping the deliverable to the government site.

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5. End of Data Pre-Acceptance Procedures —

The deliverable data has been accepted.

6. Return the Data —

Return the data and all applicable documentation to the contractor by following procedures in accordance with contract requirements for data rejection. At the government site, follow procedures for packaging and shipping rejected data and all associated documentation to the contractor. At the contractor site, follow procedures for returning physical media or identifying rejected data in a Deliverable Files Database.

When the corrected data is received from the contractor, resume the Pre-Acceptance Procedures. Go to Procedure 2.

9.0 SUMMARY

This document, *Computer Assisted Data Acceptance Procedures*, provides recommended procedures that apply to the pre-acceptance of digital engineering data at contractor sites or government repository sites. They were developed from the results of field testing the manual quality assurance and data acceptance procedures, and are based upon the model that depicts the attributes of the repository's requirements for the acceptance of engineering data in CALS format. Each of the manual procedures was analyzed for its candidacy for automation and those that were candidates for automation were combined to form a set of pre-acceptance procedures. The procedures require the existence of CADA hardware and software, trained government inspectors and a well-written contract. Five (5) procedures are proposed for automating the pre-acceptance of engineering data. The procedures are summarized as follows.

1. Procedure 1 - Set CADA Parameters

The government inspector enters the contract specified data such as site identification, contractor identification, inspector identification and acceptance criteria.

2. Procedure 2 - Load the Data

The government inspector loads the contractor deliverable data and ensures that the CADA systems verification of the format, contract number and number of files is accurate. If loading is not acceptable, a reject report is generated and signed by the inspector and the deliverable returned to the contractor for correction.

3. Procedure 3 - Process the Data

The inspector initiates the processing of all the data by the CADA system. Upon completion of the processing, the inspector verifies that all files have been processed.

4. Procedure 4 - Analyze the Results

The inspector reviews the process output and performs visual inspection of selected marginal and rejected files. Based on the inspector's judgment, files that were rejected or deemed marginal by the CADA system are either accepted or rejected. The inspector then performs a statistical

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inspection of the CADA accepted files to verify that there no false acceptances.

5. Procedure 5 - Accept/Reject the Data

The inspector reviews the final status report from the CADA system and accepts or rejects the data lot or individual files with comments where appropriate. The CADA system generates the Accept or Reject report, the inspector signs it and then forwards or returns the data with the Accept or Reject report to the contractor or appropriate government agency.

APPENDIX A - CONTRACTOR SITE IMPLEMENTATION

This example describes how CADA procedures could be implemented at a contractor site. The scenario and the possible outcomes presented are for illustration purposes only. They are based on specific assumptions that may not apply to a particular weapon system procurement. The following are some assumptions for this scenario.

1. The deliverable is a one-volume file set on magnetic tape containing 1000 files.
2. No government pre-acceptance will be performed at the government site.
3. The contract specifies that for Pre-Acceptance at the contractor site, the minimum acceptable percentage is 100%.
4. Pre-Acceptance is being done on a stand-alone graphics workstation consisting of a 33 mHz 80386 CPU, 8 MB RAM, a 15" VGA monitor, a 150 MB fixed disk, a magnetic tape drive, and a printer.

Procedure 1 - Set CADA Parameters

1. Enter Government Agency Name √
2. Enter Government Agency POC Name √
3. Enter Government Agency POC Telephone √
4. Enter Contractor CAGE ID √
5. Enter Contractor Name √
6. Enter Contractor POC Name √
7. Enter Contractor POC Telephone √
8. Enter Inspector Name √
9. Enter Inspector Telephone √
10. Enter Data Acceptance Site Name √

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11. Enter Contract Number √
12. Enter Number of Deliverable Files √
Enter 1000
13. Enter Minimum Acceptable Percentage √
Enter 100%
14. Enter Data Quality Parameters √
15. Enter other required parameters √
16. Go to Procedure 2 √
The CADA parameters have been set.

Procedure 2 - Load the Data

1. Obtain or Identify the Data √
Obtain the magnetic tape and all related documentation from the contractor personnel.
2. Load the Data √
Mount the tape on the tape drive and read the data from the tape onto the fixed disk of the CADA system.
3. Verify the deliverable format √
The system verifies that the format of the deliverable data files and their headers complies with MIL-STD-1840A.
4. Verify the contract number √
The system verifies that the contract number from the declaration file matches the contract number entered as a system parameter.

3. Review the status of the deliverable √

Based only on automatic data quality evaluation, and before the inspector has overridden the status of any file, the status of the deliverable is:

992 Accepted Files (99.2%)
3 Marginal Files (0.3%)
5 Rejected Files (0.5%):
 3 Image quality rejects:
 1 too light
 1 skewed
 1 too dark
 2 Identification Data rejects

Deliverable status: Rejected (fewer than 100% of files accepted)

4. Go to Procedure 4 √

The data has been completely processed.

Procedure 4 - Analyze the Results

1. Select image quality rejected files for review √

Select all three image quality rejected files for review.

2. Review the selected image quality rejected files √

The light image is still legible. Accept it. Enter a comment stating that the image is faint but legible.

The skewed image is acceptable. Accept it. Enter a comment stating that the drawing was not cropped significantly.

The dark image is still legible. Accept it. Enter a comment stating that the drawing is dark but legible.

3. Select identification data rejected files for review √

Select both identification data rejected files for review.

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4. Review the selected identification data rejected files √

Both Identification Data rejects are due to the failure of the system to automatically recognize the image drawing number. Accept both. Enter a comment for each file stating that the identification data was visually verified.

5. Select marginal files for review √

Select all 3 marginal files for review.

6. Review the selected marginal files √

All three marginal files are dark but still legible. Accept these three. Enter a comment stating that the drawings are dark but legible.

7. Select the accepted files for review √

Select 12 accepted files for review. Follow procedures for the system being used.

8. Review the selected accepted files √

All selected files are acceptable. None are rejected.

9. Review the status of the deliverable √

After the inspector has overridden the status of accepted or rejected files and has made a decision about all marginal files, the status of the deliverable is:

1000 Accepted Files (100.0%)
0 Marginal Files (0.0%)
0 Rejected Files (0.0%):
 0 Image quality rejects:
 0 too light
 0 skewed
 0 too dark
 0 Identification Data rejects

Deliverable status: Accepted (100% of files accepted)

10. Go to Procedure 5 √

The data has been completely analyzed.

Procedure 5 - Accept/Reject the Data

1. Review the final status √

View the final status which is that the deliverable is acceptable.
The acceptance rate is 100% which is the rate required by the contract for Pre-Acceptance performed at the contractor site.

2. Print the Accept Report √

The report will be printed indicating that the deliverable is acceptable.

3. Prepare documentation √

Prepare any additional documentation required by the contract.
Sign the Accept report and all other applicable documentation.

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4. Distribute the data ✓

Forward the magnetic tape, the accept report, and all related documentation, for packaging and shipping to the repository.

5. End of Data Pre-Acceptance Procedures ✓

The deliverable data has been accepted.

6. Return the Data —

This step will not be performed.

APPENDIX B - GOVERNMENT SITE IMPLEMENTATION

This example describes how CADA procedures could be implemented at a government user repository site. The scenario and the possible outcomes presented are for illustration purposes only. They are based on specific assumptions that may not apply to a particular weapon system procurement. The following are some assumptions for this scenario.

1. The deliverable is a one-volume file set on magnetic tape containing 1000 files.
2. No government pre-acceptance was performed at the contractor site.
3. The contract specifies that the minimum acceptable percentage is 98%.
4. Pre-Acceptance is being done on a stand-alone graphics workstation consisting of a 33 mHz 80386 CPU, 8 MB RAM, a 15" VGA monitor, a 150 MB fixed disk, a magnetic tape drive, and a printer.

Procedure 1 - Set CADA Parameters

1. Enter Government Agency Name ✓
2. Enter Government Agency POC Name ✓
3. Enter Government Agency POC Telephone ✓
4. Enter Contractor CAGE ID ✓
5. Enter Contractor Name ✓
6. Enter Contractor POC Name ✓
7. Enter Contractor POC Telephone ✓
8. Enter Inspector Name ✓
9. Enter Inspector Telephone ✓
10. Enter Data Acceptance Site Name ✓

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11. Enter Contract Number √
12. Enter Number of Deliverable Files √
Enter 1000
13. Enter Minimum Acceptable Percentage √
Enter 98%
14. Enter Data Quality Parameters √
15. Enter other required parameters √
16. Go to Procedure 2 √

The CADA parameters have been set.

Procedure 2 - Load the Data

1. Obtain or Identify the Data √
Obtain the magnetic tapes and their associated documentation after they have been physically accepted by the site.
2. Load the Data √
Load the data from the tapes on to the CADA system fixed disk.
3. Verify the deliverable format √
The system verifies that the format of the deliverable data files and their headers complies with MIL-STD-1840A.
4. Verify the contract number √
The system verifies that the contract number from the declaration file matches the contract number entered as a system parameter.

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5. Verify total number of files √

The system verifies that the number of deliverable files actually loaded matches the number of deliverable files in the contractor documentation that was entered as a system parameter.

6. Go to Procedure 3 √

The data has been successfully loaded.

7. Print the Reject Report —

This step is not performed.

8. Prepare documentation —

This step is not performed.

9. Return the Data —

This step is not performed.

Procedure 3 - Process the Data

1. Process the data files √

Start the image evaluation processing. The system will perform the processing in the foreground and will be dedicated to this task until it is done.

2. Verify that processing is complete √

Verify that the system has completed all processing by observing the appropriate change of status on the screen.

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3. Review the status of the deliverable √

Based only on automatic data quality evaluation, and before the inspector has overridden the status of any file, the status of the deliverable is:

978 Accepted Files (97.8%)
6 Marginal Files (0.6%)
16 Rejected Files (1.6%):
 10 Image quality rejects:
 5 too light
 3 skewed
 2 too dark
 6 Identification Data rejects

Deliverable status: Rejected (fewer than 98% of files accepted)

4. Go to Procedure 4 √

The data has been completely processed.

Procedure 4 - Analyze the Results

1. Select image quality rejected files for review √

Select all 10 image quality rejected files for review.

2. Review the selected image quality rejected files √

One light image is still legible. Accept this one. Enter a comment stating that the image is faint but legible.

One skewed image is acceptable. Accept this one. Enter a comment stating that the drawing was not cropped significantly.

One dark image is still legible. Accept this one. Enter a comment stating that the drawing is dark but legible.

3. Select identification data rejected files for review √

Select all 6 identification data rejected files for review.

4. Review the selected identification data rejected files √

Two Identification Data rejects are due to the failure of the system to automatically recognize the image drawing number. Accept these two. Enter a comment for each file stating that the identification data was visually verified.

5. Select marginal files for review √

Select all 6 marginal files for review.

6. Review the selected marginal files √

Three marginal files are dark but still legible. Accept these three. Enter a comment stating that the drawings are dark but legible. Three marginal files dark and illegible. Reject these three. Enter a comment stating that the drawings are dark and illegible.

7. Select the accepted files for review √

Select 12 accepted files for review. Follow procedures for the system being used.

8. Review the selected accepted files √

One file is not legible because it is too dark. Reject this one. Enter a comment stating that the image is too dark.

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9. Review the status of the deliverable √

After the inspector has overridden the status of accepted or rejected files and has made a decision about all marginal files, the status of the deliverable is:

986 Accepted Files (98.6%)
0 Marginal Files (0.0%)
14 Rejected Files (1.4%):
 10 Image quality rejects:
 4 too light
 2 skewed
 4 too dark
 4 Identification Data rejects

Deliverable status: Accepted (98% or more files accepted)

10. Go to Procedure 5 √

The data has been completely analyzed.

Procedure 5 - Accept/Reject the Data

1. Review the final status √

View the final status which is that the deliverable is acceptable. The acceptance rate is 98.6% which is above the 98% rate required by the contract for Pre-Acceptance performed at the government site.

2. Print the Accept Report √

The report will be printed indicating that the deliverable is acceptable. The report will list the fourteen rejected files and the reasons for their rejection.

3. Prepare documentation √

Prepare any additional documentation required by the contract. Sign the Accept report and all other applicable documentation.

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4. Distribute the data √

Forward the magnetic tape, the accept report, and all related documentation, for final acceptance and, if it is accepted there, storage in the repository. It is assumed that the contractor will correct the fourteen rejected files after final acceptance in accordance with the data warranty provisions of the contract.

5. End of Data Pre-Acceptance Procedures √

The deliverable data has been accepted.

6. Return the Data —

This step will not be performed.

APPENDIX C - GLOSSARY

ASCII	American Standard Code for Information Interchange
CAD	Computer Aided Design
CADA	Computer Assisted Data Acceptance
CAGE	Commercial and Government Entity
CALS	Computer-aided Acquisition and Logistic Support
CCITT	Comité Consultatif Internationale de Télégraphique et Téléphonique (English translation: International Consultative Committee on Telegraphy and Telephony)
CDRL	Contract Data Requirements List
CPU	Central Processing Unit
CTN	CALS Test Network
DA	Data Acceptance
DID	Data Item Description
DoD	Department of Defense
DSREDS	Digital Storage and Retrieval Engineering Data System
EDCARS	Engineering Data Computer Assisted Retrieval System
EDMICS	Engineering Data Management Information and Control System
EO	Engineering Order
IGES	Initial Graphics Exchange Specification
I/O	Input/Output
PM CALS	Project Manager CALS
QA	Quality Assurance
RAM	Random Access Memory
SOW	Statement of Work

APPENDIX D - REFERENCE DOCUMENTS

MIL-R-28002	Requirements for Raster Graphics Representation in Binary Format
MIL-D-28000	Digital Representation for Communications of Product Data: IGES Application Subsets
MIL-STD-1840A	Automated Interchange of Technical Information. Contractor Site Digital Data Acceptance/Quality Assurance Procedures, 9 February 1990, Department of the Army, PM CALS DSREDS/EDCARS Site Digital Data Acceptance/Quality Assurance Procedures, 9 February 1990, Department of the Army, PM CALS Model - Engineering Data, 9 December 1990, Department of the Army, PM CALS

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